THEODORE CLEVELAND ROUGHLEY, 1888–1961.

(*Memorial Series No. 19.*)

(With portrait, Plate xi.)

Theodore Cleveland Roughley, B.Sc., F.R.Z.S., who had been a member of the Linnean Society of New South Wales since 1925, its President in 1938–39, a Councillor from 1931 to 1956, and a Corresponding Member since 1957, died suddenly on 14th January, 1961, at The Entrance, Tuggerah, New South Wales.

Born at Dulwich Hill, Sydney, on 30th September, 1888, T. C. Roughley was educated at Sydney High School. He spent three years at the University of Sydney undertaking the medical course, but surgery and sickness were not to his taste, so he embarked on a career of scientific research and did not receive his degree of B.Sc. until years afterwards for his thesis on the oyster, published in 1933. On 21st August, 1911, he joined the staff of the Technological Museum, Ultimo, as Economic Zoologist, a post he held for 28 years. He delivered very many lectures and was a good after-dinner speaker, with a ready wit, and he contributed many articles on a variety of subjects to newspapers, magazines, scientific periodicals and to the *Australian Encyclopaedia.* He was an outstanding photographer and microscopist: he not only illustrated his own writings, but he photographed hundreds of illustrations for A. R. McCulloch's *Fishes of New South Wales.* His tall figure ensured success at athletics: he had played first grade cricket and baseball in early manhood and was proficient in tennis, golf and bowls. His hobby was the collection of books and works of art, himself being skilful at drawing, having studied under Julian Ashton.

The influence of Lawrence Hargrave (1850–1915) on man's pioneering efforts to fly was a lively topic for debate some years ago. Hargrave's models of flying machines had been presented to the Technological Museum, Sydney, and Roughley sought to establish Hargrave's rightful place as a pioneer of aviation. After most carefully appraising Hargrave's papers on aerodynamics and working with his actual models, Roughley concluded his appreciation of the other man's work as follows:

> "Although Hargrave's monoplanes were marvels of ingenuity and were propelled by internal combustion engines, the making of which showed his great resource, they played little part in the development of the modern aeroplane.
>
> "It is on his work on the box-kite that his fame must rest."

How Hargrave's models of box-kites went to Germany is related in the Technological Museum's Annual Report for 1919: 4. The present writer saw them in the Deutsches Museum, Munich, in 1936.

The Director (Mr. J. L. Willis) and the Keeper of Exhibits (Mr. H. L. Brown) of the Museum of Applied Arts and Sciences, Broadway, Sydney, to whom I am grateful for their help, inform me that in 1960 all Hargrave's still remaining models in the Deutsches Museum, Munich (except four engine models), were returned to their Institution, which was known as the Technological Museum in Roughley's days. Of the seventy-three models Hargrave sent to Germany, fifty-seven, including all the box-kites, were destroyed by Allied bombing during World War II.

In a review of Roughley's work, Ronald Monson pointed out in the *Daily Telegraph* newspaper, Sydney, 2nd July, 1949, p. 11:

"Using four large box-kites joined together, Hargrave, in 1894, launched himself into the air in a 21 miles-an-hour wind. He soared to 16 feet. In North Carolina in 1903 the Wright brothers made their first flights in the first power-driven aeroplane ever to fly, but the first aeroplane to fly in Europe—the one Santos-Dumont flew in France in 1906—was simply an arrangement of Hargrave box-kites. Voisin further

developed the box-kite plane and Farman produced his biplane by omitting the vertical sides of the series of box-kites which formed the wings of Voisin's plane. Thus Roughley demonstrated the direct evolution of the biplane from Hargrave's box-kites."

In 1928 Roughley conducted an interstate investigation of Australia's oyster resources and in 1929 we were shipmates aboard the Danish vessel "Dana" at the invitation of Professor Johannes Schmidt. An illustrated account of the voyage appeared in *The Australian Museum Magazine*. Roughley was also associated with the Great Barrier Reef Expedition to Low Isles.

Roughley was apparently first in the field in several fisheries matters. His photograph of a living flying fish, taken from the Danish research vessel "Dana" off the south Queensland coast in 1929 and reproduced in *The Australian Museum Magazine*, 3, 1929: 298, and in Danish and other publications was the first of its kind in the world. He encouraged F. A. Coombes in his experiments on softening and tanning shark-leather. He was responsible for the development of the fish-canning industry in Australia, encouraging local enterprise to tin prawns and mullet in the 1930s.* The migrations of the Australian marine "Salmon" (*Arripis trutta*) are still not completely understood, but Roughley considered that these fish could be sidetracked into pens at Narooma and in other coastal places so that their flavour could be improved and they would be available for canning on the spot. Unfortunately the fish did not appear at regular intervals at particular places so that several years without the appearance of shoals caused the idea to be shelved. However, canning developed rapidly in several States of the Commonwealth subsequently, using mullet, Perth herring, and tuna as well as the "Salmon" aforesaid.

Whilst our best prawning-grounds used to be considered to be inshore and in estuaries, Roughley, in the late 1930s, suggested that larger, more mature prawns would be found farther out to sea, as proved to be the case, with consequent expansion in the industry. The coloured plates in Roughley's books on fishes set a new standard of excellence in Australian ichthyology. Roughley was not a taxonomist, preferring to leave to specialists the identification of his specimens, but he named, in conjunction with Iredale, one new species of oyster and he was instrumental in donating many interesting specimens to the Australian Museum. In the field of economic zoology, however, his ability is amply demonstrated by the papers he produced.

The work which he made his own more than any other was the investigation of the biology of oysters. When he began, nothing was known of the life-history of Australia's commercial species, later to be known as *Saxostrea commercialis* Iredale & Roughley, and there were even prejudices against eating this delicious mollusc, at least the equal of any overseas. Roughley spent years studying the breeding and found that our oysters lay eggs into the water where they are fertilized, and that the very young are not retained in the gills as in the European species. In 1927 he announced his discovery of a sex change in the eastern Australian oyster which first functions as a male and later breeds as a female.

He had been a member of the Royal Zoological Society for many years, a Councillor from 1927 until recently, and was President from 1934 to 1936; the Society elected him a Fellow for his contributions to Australian zoology. Roughley was President of the Microscopical Society of New South Wales in 1926–27, Vice-President of the Aquarium Society, Sydney, and President of the Great Barrier Reef Game Fishing and Angling Club (1937), a member of the New South Wales Committee of the Council for Scientific and Industrial Research and of various aquarium, angling and sporting associations.

On 13th March, 1939, he transferred to the State Fisheries Branch of the Chief Secretary's Department, Sydney, where he was Research Officer, 1939, Deputy Controller of Fisheries in 1943–47, and ultimately became Superintendent of Fisheries. His administrative work was characterized by scrupulous fairness and integrity. In 1945 and 1946 he visited the United States of America to lecture about the Great Barrier Reef. After his retirement in September, 1952, he still took an active interest in

* *Technological Museum Annual Reports*, 1934, 1938, etc.

fisheries matters, and studied the oyster industries of the United States and the United Kingdom in 1956. He was well known in Australia for his Press comments, radio and television talks, and acted as adviser or referee in angling competitions. Indeed it was when staying at an hotel as inspector at a fishing contest that he was suddenly stricken. Mr. Roughley is survived by his widow, Mrs. Olive Roughley of Vaucluse (to whom I am grateful for assistance in the preparation of this memorial notice), and their son Mr. Clive Roughley and daughter, Norma (Mrs. W. Coombs), and two grandchildren.

Illustrated biographies of the late T. C. Roughley were published in the *Daily Telegraph* (Sydney) Magazine Section, 2nd July, 1944: 10–11, in *People*, 28th March, 1951: 28–31, and in the *Australian Monthly*, February, 1953: 63.

It is impossible to prepare a complete bibliography of Roughley's voluminous writings because hundreds of newspaper and magazine articles were contributed by him, some to ephemeral or obscure publications like certain angling journals and reports of organizations concerned with marketing fisheries products.

The appended bibliography is believed to cover the titles of all his major scientific papers and books, but some of these appeared in several editions, published in Great Britain and the United States as well as in Australia, so that collation of all editions has not been practicable, even in the fine libraries of the Australian Museum, Public Library, and Mitchell Library, Sydney, to which I am grateful for help.

G.P.W.

List of Publications by T. C. Roughley.

1913. Fishes of Australia. Their Utilisation in Applied Art. *Tech. Gazette N.S. Wales*, 3 (1): 9-12, two coloured plates and 2 text-figs. *Ibid.*, 3 (2): 10-20, two coloured plates, diagram and text-figs 1-6. *Ibid.*, 3 (3): 12-20, two coloured plates and text-figs 1-3.
1913. Modern Butter-Making. *Tech. Gazette N.S. Wales*, 3 (3): 36-42, figs 1-5.
1916. Fishes of Australia and their Technology. *Tech. Educ. Ser.*, 21, Tech. Mus. (Sydney: Govt. Printer): xvi + 296, coloured plates 1-70, figs 1-60.
1917. Edible Fishes. *The Australasian*, Oct. 27, 1917.
1920. The Evolution of the Aeroplane. *Tech. Gazette N.S. Wales*, 10 (1): 20-27, figs 1-17.
1922. Oyster Culture on the George's River, New South Wales. *Dept. Educ. N.S. Wales Tech. Educ. Ser.*, 25 (Sydney: Govt. Printer): 1-70, figs 1-29 and map.
1923. Oyster Shell Lime—Its Manufacture and Uses. *Tech. Gazette N.S. Wales*, 13 (1): 17-22, figs 1-5.
1923. (With M. B. Welch.) Notes on Wood Borers. *Tech. Gazette N.S. Wales*, 13 (2): 81-84; *Tech. Mus. Bull.*, 7 ("within a few days after publication the application for copies far exceeded the number printed").
1923. (With M. B. Welch.) Wood Borers Damaging Timber in Australia. *Tech. Mus. Bull.*, 8: 1-28, figs 1-18.
1923. Lawrence Hargrave—Australia's Pioneer in Aviation. *Tech. Gazette N.S. Wales*, 13 (2): 87-101, figs 1-11.
1924. Lawrence Hargrave—Australia's Pioneer in Aviation. Part II. *Tech. Gazette N.S. Wales*, 14 (1): 35-47, figs 12-21.
1925. The Story of the Oyster. *Austr. Mus. Mag.*, 2 (5): 163-168, 5 figs.
1925. The Birth and Growth of an Oyster. *Austr. Mus. Mag.*, 2 (6): 187-194, figs 1-9.
1925. The Cultivation of the Oyster. *Austr. Mus. Mag.*, 2 (7): 235-242, 12 figs.
1925. The Perils of an Oyster. *Austr. Mus. Mag.*, 2 (8): 277-284, 14 figs.
1925. Lawrence Hargrave (1850-1915). *Austr. Encyclopaedia*, 1: 599.
1926. Allan Rivingstone* McCulloch (1885-1925). *Austr. Encyclopaedia*, 2: 6.
1926. *Austr. Encyclopaedia*, 2: Morwong, p. 144; Oysters and Oyster Culture, pp. 241-242, Pl. 32; Tailor, p. 530; Trawling and Fisheries . . . General Fisheries, pp. 589-590; Trumpeter, pp. 597-598; Wood-borers, pp. 675-676.
1926. An investigation of the cause of an oyster mortality on the George's River, New South Wales, 1924-25. Proc. Linn. Soc. N.S. Wales, 51: 446-491, Pls XXIX-XXXIV, text-figs 1-4. Precis in *Nature*, 118 (2979), Dec. 4: 827.
1927. Catching Sharks for Profit. *Austr. Mus. Mag.*, 3 (5): 149-155, 11 figs.
1927. The Investigation of Australian Fisheries, and the necessity for the establishment of Marine Biological Stations. *Rept. Austr. Fisher. Conference* (Development and Migration Commission, Melbourne), Appendix 3: unpaged (6 pages).
1927. Some Australian Fish Problems. *Mid-Pacific Mag.* (Honolulu), 34: 13-16, 3 figs.
1928. The Dominant Species of *Ostrea*. *Nature*, 122 (3074), Sept. 29: 476-477, fig. 1.

* i.e., Riverstone.—G.P.W.

1928-29. (With F. A. McNeill.) Marine Zoological Section. *Austr. Zool.,* 5 (3): 200-201; 6 (1): 14-15.
1929. Report on the oyster resources of Queensland, Victoria and Tasmania. *Austr. Fisher. Confer. Rept.,* 2: 1-37.
1929. The Story of the Oyster, its history, growth, cultivation and pests in New South Wales. [Reprinted from the *Austr. Mus. Mag.,* 1925]: 1-32, figs, 8vo, Sydney.
1929. The Flight of Fishes. *Austr. Mus. Mag.,* 3 (9): 298-300, fig.
1929. Monoecious Oysters. *Nature,* 124 (3134), Nov. 23: 793.
1929. (With G. P. Whitley.) Deep Sea Exploration on the "Dana". *Austr. Mus. Mag.,* 3 (12): 409-413, 7 figs.
1929. (With M. B. Welch.) Wood Borers damaging Timber in Australia. Second Edition. *Tech. Mus. Bull.,* 8: 1-27, illustr.
1930. (With G. P. Whitley.) Inhabitants of the Deep. *Austr. Mus. Mag.,* 4 (1): 22-27, 7 figs.
1930. (With G. P. Whitley.) The Investigation of Ocean Waters. *Austr. Mus. Mag.,* 4 (2): 55-59, 7 figs.
1930. Do We Eat enough Fish? *Austr. Mus. Mag.,* 4 (3): 77-81, 4 figs.
1930. Our Marine Resources. *Tech. Gazette,* Second Term, 1930.
1931. Giant Oysters. *Nature,* 127 (3196), Jan. 31: 166, fig. 1.
1932. The Goldfish in the Home. *Tech. Mus. Bull.,* 18: 1-26, figs 1-12.
1933. The Cult of the Goldfish. (Sydney: Angus & Robertson. London: Australian Book Company. Published April 19, 1933.) i-xiii + 1-146, Pls 1-28, text-figs 1-2. Second edition, revised, 1949: i-xv + 1-169, coloured frontispiece, Pls i-xiv, xiv*a*, xv-xvii and text-figs 1-2. Third edition, 1955.
1933. (With T. Iredale.) The Scientific Name of the Commercial Oyster of New South Wales. Proc. Linn. Soc. N.S. Wales, 58: 278.
1933. The Life History of the Australian Oyster (*Ostrea commercialis*). Proc. Linn. Soc. N.S. Wales, 58; 279-332, Pls 10-27, text-figs 1-2.
1934. The Australian Oyster. *Nature,* 134 (3376), July 14: 66.
1935. Presidential Address. The Fisheries of Australia. *Proc. Roy. Zool. Soc. N.S. Wales,* 1934-35: 9-20.
1936. The Retailing of Fish. *Master Fishmongers' Assoc. N.S. Wales Ann. Rept.,* 1935-36: 5-6.
1936. Presidential Address. The Oyster. *Proc. Roy. Zool. Soc. N.S. Wales,* 1935-36: 9-19.
1936. Wonders of the Great Barrier Reef. (Sydney and London: Angus & Robertson, first published November 19, 1936): xiii + 282, coloured frontispiece and plates 1-50. Many reprints of the first edition appeared: 1936, 1937, 1939, 1941, 1943 (July and September), 1945, 1946, 1947, 1948, 1949 and 1954 and probably others. Scribner's New York edition, 1947.
1937. The Great Barrier Reef of Australia. *The Home Annual,* 1937: 57-59, 72 and 80, illustr.
1937. Australia's Big-Game Angling. *Walkabout,* 4 (1), Nov. 1: 13-18, 12 figs.
1939. Presidential Address. A Review of the Scientific Investigation of the Fisheries of New South Wales. Proc. Linn. Soc. N.S. Wales, 64: vi-xxvii.
1939. Australia cans fish. *Walkabout,* November, 1939: 33-36, 7 figs.
1939. The Aeronautical Work of Lawrence Hargrave. Second edition.* *Tech. Mus. Bull.,* 19: 1-40, portrait of Hargrave and figs 1-25.
1940. Where nature runs riot on Australia's Great Barrier Reef. Marine animals grow to an unusual size, develop strange weapons of attack and defence and acquire brilliant colours. *Nat. Geog. Mag.,* June, 1940; 823-850, with coloured plates.
1941. Report on the Fisheries of New South Wales for the year ended 30th June, 1940. *Parliament of N.S. Wales*: 1-5. And reports of later years at least until 1946.
1949. Conserving the Murray Cod. *Outdoors and Fishing,* November, 1949: 179-180, fig.
1949. Australia—The Anglers' Paradise. In *Gamefish of the World* by B. Vesey-Fitzgerald and F. Lamonte. (London: Nicholson and Watson): 287-294, Pls 55-64.
1951. Fish and Fisheries of Australia. (Sydney and London: Angus & Robertson, first published December 3rd, 1951): xv + 344, frontispiece and Pls 1-80 (60 coloured and 21 black and white) and text-figs 1-10.
1953. Our six best fish. *Australian Monthly,* February, 1953: 16-17, 5 figs.
1958. *Austr. Encyclopaedia,* 1: Angling, pp. 180-186, Pl. 186A; Aquaria, pp. 220-221; *Austr. Encyclopaedia,* 3: Crayfish Industry, pp. 93-94, Pl. 92A; 4: Fisheries, pp. 77-84, Plates 82A-82B; 6: Murray Cod, pp. 204-205, fig.; Oysters and Oyster Culture, pp. 432-434, Pl. 434A; 8: Tailor, p. 409; 9: Wood-borers, pp. 348-349.
1960. *Bounty* Descendants Live on Remote Norfolk Island. *Nat. Geog. Mag.,* 118 (4), Oct., 1960: 558-584, illustrated.

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* Though termed "second edition", I have not found any earlier edition of this paper which embodied two articles published in *Tech. Gazette N.S. Wales.* 13 (2), 1923 and 14 (1), 1924, which may thus have been regarded as the first edition.—G.P.W.